INTT Sensor Coverage

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Outer detectors

All of the luminosity estimates we have presented for the sPHENIX physics program were made assuming $|\eta| < 1.1$ (subtended at Z=0) and collision vertex within $|Z| < 10$ cm.

For the outer detectors, the effect of moving the collision vertex to +/- 10 cm is small. For example at the largest radial extent of the TPC (78 cm), the TPC length of 211 cm subtends:

from $Z = 0$	$-1.1 \ < \eta < 1.1$
from $Z = 10$ cm	$-1.18 < \eta < 1.03$

- not a big change in η because the change in Z is small compared with the radius.

A reasonable criterion for the length in Z of the inner tracking detectors is that they cover the entire acceptance of the TPC for all collisions within $-10 < Z < 10$.

MAPS detectors

How do the MAPS layers (fixed at 27 cm long) match the TPC acceptance for events at Z = 10 cm?

TPC acceptance - $1.18 < \eta < 1.03$

Layer	radius (cm)	Z vertex (cm)	η range
0	2.3	10	- 3.02 to +1.21
1	3.2	10	- 2.7 to + 0.95
2	3.9	10	- 2.5 to + 0.81

Not perfect, but not too bad. The first two MAPS layers are matched pretty well.

INTT detectors

What length do we need for the INTT layers to match the TPC acceptance for events at Z = 10 cm?
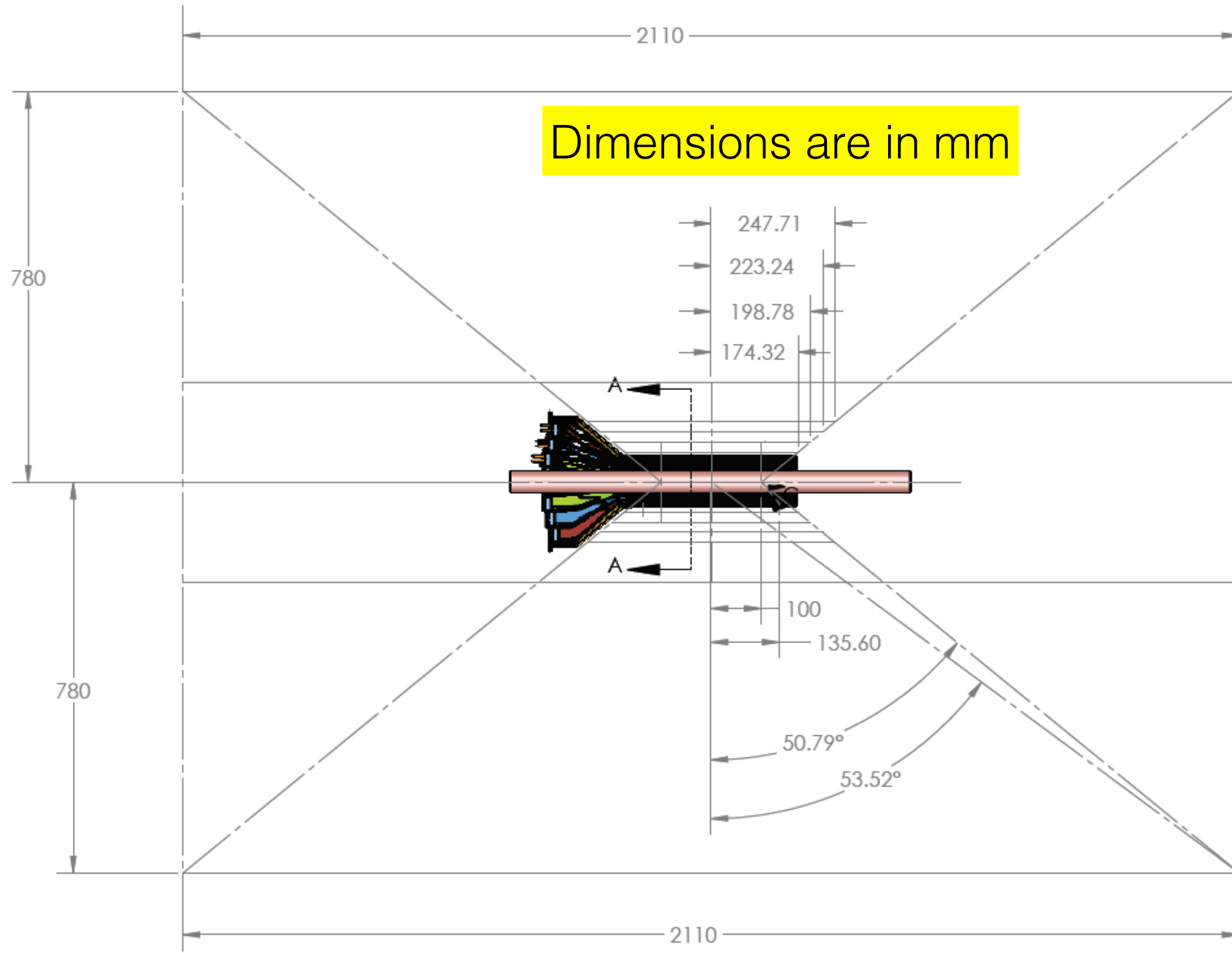
Walt Sondheim made the drawing on the next slide. It shows lines that connect the +/- 10 cm points on the beam axis to the back of the TPC on the same side (half angle of 50.79^0).

To just cover the acceptance of the TPC, the active part of the INTT layers should touch those lines. This leads to the following table for the minimum active length of the INTT layers:

Layer	radius (cm)	total active length (cm)
3	6	34.8
4	8	39.8
5	10	44.6
6	12	49.4

INTT active length drawing

Note the likely conflict with the cabling for the MAPS inner barrel. Remember that the lines are only the active length of the INTT layers.

Dimensions are in mm

2110

780

780

2110

247.71

223.24

198.78

174.32

A

A

100

135.60

50.79°

53.52°

Drawing PDF file

The pdf of Walt's drawing is posted with these slides at:

https://indico.bnl.gov/conferenceDisplay.py?confId=2374

Conclusions

To cover the acceptance of the TPC for all collisions within a Z vertex range of +/- 10 cm will require active INTT layer lengths in the range of about 35 - 50 cm, depending on layer radius.

This will lead to conflicts with the existing design of the readout/bias cabling for the MAPS inner barrel.